DECUS
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DECUS NO.	8-400a
TITLE	EXECUTE SLOW
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DATE	February 1974
SOURCE LANGUAGE	MACRO-8

EXECUTE SLOW

DECUS Program Library Write-up | DECUS NO. 8-400a

ABSTRACT.

Execute Slow will execute the user's program one instruction at a time. Before the instruction is executed the LINK, ACCUMULATOR, PROGRAM COUNTER and INSTRUCTION are printed on the ASR33. The program only occupies one page, in any field, plus locations 0000 to 0003 in field zero, and differs from most trace programs in that the user instructions are actually executed from the user's original location. Subroutine tracing can be turned off.

Minimum Hardware:	4K PDP-8, ASR33
Storage Requirement:	Locations 0000 through 0003 in field zero. 6600-6777 (1 page) in any field
Restrictions:	User interrupts may not be used. The 6002 instruction is not allowed. Instructions with an effective address of .-1 may cause incorrect execution of traced program.
Source Language:	MACRO-8

MULTI-FIELD "EXECUTE SLOW"

PURPOSE:-

THE "EXECUTE SLOW" PROGRAM EXECUTES THE USER'S PROGRAM ONE INSTRUCTION AT A TIME. BEFORE EACH INSTRUCTION IS EXECUTED, THE LINK, ACCUMULATOR, PROGRAM COUNTER AND INSTRUCTION ARE PRINTED ON THE TELETYPE. THE PRINTING CAUSES THE SLOW EXECUTION OF THE USER'S PROGRAM. THE MULTI-FIELD "EXECUTE SLOW" PROGRAM NEED NOT BE RESIDENT IN THE FIELD CONTAINING THE PROGRAM TO BE EXECUTED, SINCE MULTI-FIELD LINKAGE IS PROVIDED.

THIS PROGRAM DIFFERS FROM MOST TRACE PROGRAMS IN THAT IT ACTUALLY EXECUTES THE USER'S INSTRUCTIONS FROM THE USER'S ORIGINAL CORE LOCATIONS. THIS IS ACCOMPLISHED BY USING THE INTERRUPT FACILITY AND THE FACT THAT THE "ION" INSTRUCTION DOES NOT TAKE EFFECT UNTIL ONE INSTRUCTION FOLLOWING IT HAS BEEN COMPLETED. SINCE THE TRACE PROGRAM ITSELF REQUIRES THE INTERRUPT, THE USER'S PROGRAM SHOULD NOT USE THE INTERRUPT. THE INSTRUCTION "IOF" (WHEN EXECUTED) WILL TURN THE INTERRUPT OFF AND STOP THE TRACE PROGRAM.

NOTE THAT THIS PROGRAM CANNOT HANDLE INSTRUCTIONS WITH AN EFFECTIVE ADDRESS OF .-1, DUE TO THE REPLACEMENT OF THE INSTRUCTION PRIOR TO THAT ABOUT TO BE EXECUTED BY "ION".

ASSEMBLING THE "EXECUTE SLOW" PROGRAM:-

1/. PREPARE A SHORT TAPE CONTAINING:-

N=00XX
M=00YY
W=VV00

WHERE X = FIELD CONTAINING PROGRAM TO BE EXECUTED.
Y = FIELD TO CONTAIN THIS PROGRAM.
VV00 = REQUIRED STARTING ADDRESS OF THIS PROGRAM. MUST BE THE FIRST LOCATION ON A PAGE.

2/. USE THIS SHORT TAPE AS THE FIRST INPUT TO THE ASSEMBLER, WHICH MUST BE MACRO-8 OR PAL-D DUE TO THE USE OF LITERALS AND BINARY OPERATORS IN THE SOURCE CODING.

3/. ASSEMBLE THE SOURCE TAPE AS USUAL.

RUNNING THE "EXECUTE SLOW" PROGRAM:-

1/. CHOOSE FIELDS FOR "EXECUTE SLOW" AND PROGRAM TO BE TRACED.

2/. LOAD PROGRAM TO BE TRACED.

3/. LOAD VERSION OF "EXECUTE SLOW" APPROPRIATE TO CHOSEN FIELDS.

4/. SET THE SWITCH REGISTER TO THE STARTING ADDRESS (VV00) OF "EXECUTE SLOW" - 6600 IN BINARY VERSIONS SUPPLIED.

5/. PRESS LOAD ADDRESS ON COMPUTER.

6/. PRESS START, COMPUTER HALTS AT VV01.

7/. SET THE SWITCH REGISTER TO THE STARTING ADDRESS OF THE PROGRAM TO BE EXECUTED SLOW.

8/. PRESS CONTINUE.

9/. THE TELETYPE WILL BEGIN TO PRINT THE CONTENTS OF:-

LINK ACCUMULATOR PROGRAM COUNTER INSTRUCTION

10/. THE SWITCH REGISTER SET EQUAL TO ZERO WILL EXECUTE BUT NOT PRINT SUBROUTINE INSTRUCTIONS. (NOTE: SUBROUTINES WITH ARGUMENTS WILL NOT TURN PRINT BACK ON).

11/. A NON-ZERO SWITCH REGISTER WILL ALWAYS PRINT THE LINE.

12/. ALWAYS STOP THE TRACE BY HITTING ANY TELETYPE KEY.

13/. RESUME THE EXECUTE SLOW BY PRESSING CONTINUE.

"EXECUTE SLOW" STORAGE REQUIREMENTS:-

0001-0003 IN FIELD ZERO
VV00-VV00+0177 (ONE PAGE) IN APPROPRIATE FIELD.

STARTING ADDRESS:-

AS CHOSEN AT ASSEMBLY TIME.

THE BINARY TAPE, SUBMITTED TO DECUS WITH THIS WRITE-UP, CONTAINS FOUR VERSIONS OF THE MULTI-FIELD "EXECUTE SLOW":-

#1: PROGRAM FIELD 0; "EXECUTE SLOW" FIELD 0
#2: PROGRAM FIELD 1; "EXECUTE SLOW" FIELD 1
#3: PROGRAM FIELD 0; "EXECUTE SLOW" FIELD 1
#4: PROGRAM FIELD 1; "EXECUTE SLOW" FIELD 0

STARTING ADDRESS FOR ALL VERSIONS IS 6600

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/MODIFIED "EXECUTE SLOW" - DECUS 8-400.
/ALLOWS MULTI-FIELD OPERATION.

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/AUSTRALIA 2600.


/            ASSEMBLY INSTRUCTIONS.

/        1/.  PREPARE A SHORT TAPE CONTAINING:-
/                N=00XX
/                M=00YY
/                W=VV00

/                  WHERE  X = FIELD CONTAINING
/                           PROGRAM TO BE
/                           EXECUTED.
/                       Y = FIELD TO CONTAIN
/                           THIS PROGRAM.
/                    VV00 = REQUIRED STARTING
/                           ADDRESS OF THIS
/                           PROGRAM. MUST BE
/                           FIRST LOCATION ON
/                           A PAGE.

/        2/.  USE THIS SHORT TAPE AS FIRST INPUT
/             TO THE ASSEMBLER, WHICH MUST BE
/             EITHER MACRO-8 OR PAL-D DUE TO
/             THE USE OF LITERALS AND BOOLEAN
/             OPERATIONS IN THE SOURCE CODING.

/        3/.  ASSEMBLE THIS SOURCE TAPE AS
/             USUAL.
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                        N=0000
                        M=0011
                        W=6600

                        FIELD 0

                        *0

00000  0000  INTRPT,    0
00001  6213             CDF CIF M&0070
00002  5403             JMP I .+1
00003  6665             INT

                        FIELD M&0007

                        *W

16600  7300  START,     CLA CLL
16601  7402             HLT
16602  3356             DCA IOSW
16603  7604             LAS
16604  3362  RUN,       DCA PC
16605  7240             CLA CMA
16606  1362             TAD PC
16607  3361             DCA PC-1
16610  6201             CDF N&0070
16611  1761             TAD I PC-1
16612  3360             DCA PCINS
16613  1377             TAD (6001
16614  3761             DCA I PC-1
16615  6211             CDF M&0070
16616  7604             LAS
16617  7640             SZA CLA
16620  5245             JMP OUT
16621  1356             TAD IOSW
16622  7640             SZA CLA
16623  5240             JMP INTEST
16624  6201  B,         CDF N&0070
16625  1762             TAD I PC
16626  0376             AND (7000
16627  1375             TAD (4000
16630  6211             CDF M&0070
16631  7640             SZA CLA
16632  5257             JMP PE
16633  2356  XXXX,      ISZ IOSW
16634  1362             TAD PC
16635  7001             IAC
16636  3357             DCA RETRN
16637  5257             JMP PE
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16640  1362  INTEST,  TAD PC
16641  7041            CIA
16642  1357            TAD RETRN
16643  7640            SZA CLA
16644  5260            JMP E
16645  3356  OUT,      DCA IOSW
16646  5224            JMP B
16647  7402  CRLFS,    HLT
16650  4341            JMS CRLF
16651  1363            TAD SLINK
16652  1244            TAD INTEST+4
16653  4347            JMS TYPE
16654  1243            TAD INTEST+3
16655  4347            JMS TYPE
16656  5647            JMP I CRLFS
16657  4302  PE,       JMS PSEQ
16660  1363  E,        TAD SLINK
16661  7110            CLL RAR
16662  1364            TAD SAC
16663  6203            CDF CIF N&0070
16664  5761            JMP I PC-1
16665  3364  INT,      DCA SAC
16666  7004            RAL
16667  3363            DCA SLINK
16670  1360            TAD PCINS
16671  6201            CDF N&0070
16672  3761            DCA I PC-1
16673  6031            KSF
16674  5277            JMP .+3
16675  6032            KCC
16676  7402            HLT
16677  6201            CDF 0
16700  1774            TAD I (INTRPT
16701  5204            JMP RUN
16702  7402  PSEQ,     HLT
16703  4247            JMS CRLFS
16704  1364            TAD SAC
16705  4315            JMS PRINT4
16706  1362            TAD PC
16707  4315            JMS PRINT4
16710  6201            CDF N&0070
16711  1762            TAD I PC
16712  6211            CDF M&0070
16713  4315            JMS PRINT4
16714  5702            JMP I PSEQ
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```
06715  7402  PRINT4,  HLT
06716  7004            RAL
06717  3355            DCA WORD
06720  4327            JMS CHARP
06721  4327            JMS CHARP
06722  4327            JMS CHARP
06723  4327            JMS CHARP
06724  1243            TAD INTEST+3
06725  4347            JMS TYPE
06726  5715            JMP I PRINT4
06727  7402  CHARP,    HLT
06730  1355            TAD WORD
06731  7006            RTL
06732  7004            RAL
06733  3355            DCA WORD
06734  1355            TAD WORD
06735  0373            AND (0007
06736  1244            TAD INTEST+4
06737  4347            JMS TYPE
06740  5727            JMP I CHARP
06741  7402  CRLF,     HLT
06742  1372            TAD (215
06743  4347            JMS TYPE
06744  1371            TAD (212
06745  4347            JMS TYPE
06746  5741            JMP I CRLF
06747  7402  TYPE,     HLT
06750  6046            TLS
06751  6041            TSF
06752  5351            JMP .-1
06753  7200            CLA
06754  5747            JMP I TYPE

06755  0000  WORD,     0
06756  0000  IOSW,     0
06757  0000  RETRN,    0
06760  0000  PCINS,    0
06761  0000            0
06762  7402  PC,       HLT
06763  0000  SLINK,    0
06764  0000  SAC,      0

06771  0212
06772  0215
06773  0007
06774  0000
06775  4000
06776  7000
06777  6001
```

B	6624
CHARP	6727
CRLF	6741
CRLFS	6647
E	6660
INT	6665
INTEST	6640
INTRPT	0000
IOSW	6756
M	0011
N	0000
OUT	6645
PC	6762
PCINS	6760
PE	6657
PRINT4	6715
PSEQ	6702
RETRN	6757
RUN	6604
SAC	6764
SLINK	6763
START	6600
TYPE	6747
W	6600
WORD	6755
XXXX	6633